JPRS 83293

19 April 1983

East Europe Report

SCIENTIFIC AFFAIRS

No. 775

19990615 126

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS 83293

19 April 1983

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 775

CONTENTS

BULGARIA

Research, Experiments To Harness Solar Energy Outlined
(Yuliya Stoyanova; TEKHNICHESKO DELO, 26 Feb 83)............ 1

CZECHOSLOVAKIA

Impact of Electronics on National Economy Outlined
(Ludvik Bednar; REVUE OBSCHODU/PRUMYSLU/HOSPODARSTVI,
No 12, 1982).. 5

Robot Production Plan for 1981-1985 Under Fire
(Milos Fibiger; TRIBUNA, No 7, 1983)...................... 15

Briefs
Scientific Goals in Agriculture 20

HUNGARY

History, Structure, Functions of Science Policy Committee
Highlighted
(Pal Tetenyi Interview; MAGYAR HIRLAP, 1 Mar 83)........... 21

YUGOSLAVIA

Energoinvest Developing Industrial Robot Technology
(Halima Cipovic Interview; OSLOBODJENJE, 2 Mar 83)......... 25

RESEARCH, EXPERIMENTS TO HARNESS SOLAR ENERGY OUTLINED

Sofia TEKHNICHESKO DELO in Bulgarian 26 Feb 83 p 11

[Article by Yuliya Stoyanova: "Electricity From the Sun"]

[Text] It is universally known that today energy is the essence and the base of economy, technology and human life. However, scientific and technical progress is so fast that the growth rates of energy consumption are clearly outstripping the dynamics of its production. That is why, facing the real threat of an energy crisis, mankind is becoming increasingly interested in sources which were considered until recently not particularly promising--the energy which is "dispersed" around us--that of the wind, the tides and the sun....

The sun. Within this huge thermonuclear reactor, several million tons of hydrogen burn out in a single second. And although the earth receives no more than one-billionth part of this energy, in a single year the amount received by our planet is severalfold higher than the energy contained in all currently known minerals.

That is why the scientists turned their sights to the sun. In Bulgaria applied science research, development and production activities in the field of solar energy are divided among the New Energy Sources NPK [Scientific Production Combine] and the Central Laboratory for Solar Energy and New Energy Sources (SENEI) of the BAN [Bulgarian Academy of Sciences].

The laboratory studies the development of air heat collectors which can be used in heating buildings, drying installations and other agricultural systems. It develops fine optical covers needed for improving solar installations, and others.

One of the main problems in the use of solar energy, on which Bulgarian scientists are working, is its conversion into electric power. The principle has been known in its general lines for quite some time. It is that in radiating a semiconductor plate a corresponding electric potential is created on both its sides. It is the result of its heterogeneous nature which could include, for example, the R-p transfer.

However, a principle is one thing and the matter of problems related to the processes of the transformation of solar into electric energy another. A number of problems remain. The photoelement must absorb maximally the solar

spectrum so that the energy of the solar light quanta can be maximally transformed into the energy of electric loads. Another problem is to increase the coefficient of fission, which is related to the length of the diffusion of the electron. It is necessary maximally to "harvest" the separate current carriers before they have recombined. This means that the geometry and the material of the electrodes must be optimized. The most important task is to find a suitable inexpensive technology for the production of the basic material and the creation of the R-p transfer, and the application of the electrodes and the capping of the light element which must not age in the course of its utilization.

We know that for the time being the possibility of using photoelectric transformers of solar energy are better than thermal transformers due to the absence of thermodynamic limitations. And although the expected photoelectric power plants will probably find an application much later than the thermal, it appears that it is they which will provide a more radical solution to the problem of the utilization of solar energy.

For several years the SENEI has worked on this topic in two basic directions. The first is the development of photoelements based on silicium. This is one of the materials currently used most extensively in the conversion of solar into electric energy, mainly because of its extensive availability on the planet. Monocrystal, polycrystal, and amorphous silicium is used.

The laboratory's specialists have developed a monocrystal silicium photoelectric transformer and the technology for its production was developed with the help of the Lenin VMEI [Higher Machine-Electrical Institute] and the NPK [Scientific Production Combine] for semiconductor equipment in Botevgrad. It is based on the use of discarded integrated silicium washers. Properly processed, they are converted into light elements with a 15 percent efficiency (we must bear in mind that a 15 percent efficiency is a value close to the maximum). An equally important fact is that the technology has been adapted to plant production conditions and that the production of such photoelements may be undertaken with the equipment available at the plant.

Therefore, perhaps the time is not too distant when our transistors, tape recorders, pocket calculators and many other items so necessary to us will be powered exclusively by sunlight. Furthermore, such photoelectric transformers will be useful in larger installations in navigation, radio relay systems, independent social heating systems, and so on.

Naturally, these possibilities are tempting. However, since gas diffusion is the basis of such technology, requiring expensive equipment and, therefore, increasing the cost of the photoelements substantially, the laboratory is intensively engaged in the development of a new method. According to the scientists it will be several times less expensive, for it will eliminate the need for gas diffusion. The silicium plates will be simply placed side by side and will be baked in an air or inert atmosphere. This considerably reduces energy outlays and the time needed for the production of light transformers. Some success has already been achieved. The efficiency, however, remains

inadequate, although encouraging experiments have been made and the SENEI personnel hope that they will be able to develop new and considerably less expensive technology for the production of monocrystal silicium photoelements.

As to the light transformers based on fine layers of amorphous silicium, the laboratory scientists and specialists have developed for the first time in the world a method for their production based on silicium deposits in its gaseous phase--amorphous silicium. It was believed until recently that this method cannot yield a sensitive silicium suitable for light elements. However, the experiments conducted by the Bulgarian scientists have proved the opposite. Interestingly enough, IBM also reported, subsequently however, that it had obtained the same type of amorphous silicium layers. The efforts of the scientists are now concentrated on determining the mechanism through which the current flows and finding optimal conditions for obtaining the most suitable layers for such light transformers.

Cadmium sulfide seems a promising material for photoelements. If fine layers of cadmium sulfide are evaporated in a vacuum a base stratum is obtained on which copper sulfide is applied. A heterotransition develops in this case, which has the same properties as the R-p silicium conversion. Such photoelements are being developed in several countries. So far their highest efficiency reached has been 8-10 percent. Their advantage compared to silicium is the simplicity in the production, which significantly reduces their cost. Since the phototransformers based on cadmium sulfide make integral performance possible, it is expected that initially they will be used in small systems such as pocket calculators.

The SENEI has completed prototypes of such photoelements. However, the studies conducted by the Bulgarian scientists have not stopped there. They asked themselves why is it that the second stratum should necessarily consist of copper sulfide and what would happen if chromium sulfide or chromium tellurite are used? Experiments conducted at the laboratory have been quite hopeful. The light transformers obtained on this basis have better features compared with the traditional ones. The studies conducted by the Bulgarian scientists in this area are original. For the time being no other laboratory has obtained heterotransitions on the basis of such materials.

Bound together, the light elements form a module which provides current with a tension of several volts and a series of modules become a solar battery. Although for the time being it may be quite premature to speak of the extensive use of solar electric power plants because of the still high cost of the photoelements, such batteries may be already put to practical use quite effectively in a number of areas. Initial experiments in this area are under way in our country.

The SENEI has developed a solar battery which will power equipment developed at NIPRORUDA for cutting large marble or granite blocks. Several electrodes related to a series of condensors are driven into the rock. The energy for charging the condensors is provided precisely by a solar battery for 15 to 20 minutes. An explosion and high pressure develops where the electrodes are

discharged and the block of rock is separated. The advantage is unquestionable, for so far the equipment was powered by cables strung over large distances, which created great difficulties.

Will solar energy be applied extensively? The future will answer this question. Perhaps our descendants will build huge solar batteries in outer space from which electric current will be transmitted to the earth. Or else artificial islands--modules--will be set up in the ocean, the energy of which will be obtained by electrolyzing hydrogen, thus turning the 21st century into the "solar century."

5003
CSO: 2202/8

IMPACT OF ELECTRONICS ON NATIONAL ECONOMY OUTLINED

Prague REVUE OBSCHODU/PRUMYSLU/HOSPODARSTVI in Czech No 12, 1982 pp 18-22

[Article by Eng Ludvik Bednar, CSc, Federal Ministry for Technical and Investment Development: "Progress in the Incorporation of Electronics in the National Economy"]

[Text] The current process of intensification of economies worldwide involves an increasing degree of automation of the control of machinery and production processes by extensive use of electronic components and systems.

The degree of development and utilization of electronics constitutes one of the limiting factors for increasing the technical quality and utility characteristics of integrated machine complexes and integrated plants. A key role in this process belongs to the electrotechnical industry, which is creating the material base for incorporation of electronics into the national economy.

In discussing the concept for development of the electrotechnical industry during the Seventh and Eighth 5-Year Plans, the CSSR Government Presidium also dealt with the problem of incorporation of electronics into the national economy; among other assignments, its decree No 250/80 of 30 October 1980 included the following:

--the minister of the electrotechnical industry was instructed to assure the provision of electronic components, assemblies, standard control systems for automation of machinery, equipment and manufacturing processes, as well as technical documentation for planners and designers, in order to support the incorporation of electronics into the national economy;

Vice presidents J. Korcak and P. Colotka of the CSSR Government Presidium and the ministries of the production departments were assigned to create development, planning, design and production capacities in the various sectors for the application of products and systems which will promote the incorporation of electronics into the national economy, using components, assemblies and standard systems produced by the electrotechnical industry;

--the minister for technological and investment development was instructed to monitor and evaluate the process of incorporation of electronics into the

national economy and to inform the Government Presidium of the results by 30 June 1983.

Evaluation of the progress to date indicates the necessity of speeding up the pace of incorporation of electronics and improving the quality of the preparations for it, because the time required for beginning series production of highly advanced products equipped with microelectronic systems in this country is excessively long compared with those of the competition.

Basic Preconditions for the Incorporation of Electronics

The basic precondition for incorporation of electronics into the national economy is the availability of an adequate selection of electronic components and systems at suitable prices, both from domestic production and from imports. The "foundation stones" which make up the required selection are active electronic and particularly microelectronic components, whose technical and economic characteristics are reflected both within the electrotechnical industry and in all user sectors.

The production of active microelectronic components involves extremely high expenses in the preproduction stage. These result, on the one hand, from special chemical, photochemical and other processes, and, on the other hand, from the need for extremely demanding, expensive production, testing and measuring equipment. One factor is the extreme cleanliness of the production environment itself (4 particles measuring more than 0.5 microns in each liter of air) and the great purity of the substrate materials (99.99 to 99.9999 percent). The high research and development cost creates an economic barrier which can be overcome only by large-series production, so that the preproduction investment and noninvestment expenses will represent only a small part of the cost of each unit. The effect of economic barriers to the production of microelectronic components, as distinguished from the relative expenditures on the different phases of the innovation process for units produced by the electrotechnical industry in advanced industrial countries is shown in Table 1. The research and development [R&D] state is 1.67 times as expensive in electrical engineering as in mechanical engineering and 1.6 times as expensive as is all industrial sectors [figures as published].

Table 1. Relative costs in phases of innovation process in electrotechnical industry, mechanical engineering, and industry overall (in percentage)

Phase of innovation	Electrotechnical industry	Mechanical Engineering	Industry Overall
Research and development	77	43	46
Investment	13	6	20
Design	7	19	13
Tooling and preparation	6	18	11
Startup of production	1	8	6
Marketing	1	3	2
Patenting, financing, organization	1	3	2

The high degree of integration of microelectronic circuits and the great saving in their production have resulted in a fall in their price as individual commodities on foreign markets; the prices are expected to drop further. This fact has affected the development of applications of electronic devices even where no such effect was expected 10 years ago. The smaller physical dimensions, the resulting high prices per kilogram and the low transport costs, support the great commercial mobility of electronic components and systems. This results in a high rate of growth of international exchange of electronic products.

The involvement of the electronic industries in the national economies in international exchange is documented in Figure 1 [not reproduced]. The sample of 13 West European countries is arranged in terms of population. The ratio of export and import of electronics to domestic production and consumption in the individual economies indicates their high degree of integration into international exchange, which increases with decreasing size of the country.

While Czechoslovakia is on the same level as other economically developed countries in terms of the rate of growth of output, the same is not true of the degree to which it participates in international exchange. A low degree of utilization of international production specialization deprives Czechoslovak electronics of many effects in such areas as technical conditions of production, extent of series production, costliness, wide selection in the use phase, the advantages stemming from the possibility of concentrating scientific research capacities, and effects stemming from the "training" effect of a solid share of demanding markets. The ratio of exports to production was a mere 20 percent in 1980, while the ratio of imports to domestic use was less than 35 percent, which is approximately one-half to two-fifths the figure in West European countries comparable in size and economics. Increasing the degree of integration of Czechoslovak electronics into international exchange is one of the problems whose solution will lay the groundwork for expanding the use of electronics in the Czechoslovak economy.

The CEMA member countries are fully aware of this situation. As a result, at the 36th CEMA Congress a "Program for Cooperation in the Development and Utilization of Microprocessor Technology in the National Economies of CEMA Member Countries in 1982-1990" was adopted. This program, together with an agreement on multilateral international specialization and cooperation in the development and production of basic microelectronics components for data processing equipment and special production equipment and extremely pure materials for microelectronics will be the basic document bringing about an increase in the participation of the Czechoslovak electronics industry in international exchange.

Domestic production and import of electronics constitute the entire supply for national electronics, its "supply base," which is divided among the "user sectors" (see Table 2). In the past decade the average consumption of electronics in the material expenditures of the national economy increased from 0.69 percent to 1.2 percent.

Table 2. Average consumption of electronics in the national economy

	Average consumption (percentage) 1970	1980	Increase in average consumption, index 1970/1980	Projected increase in average consumption in year 2000, %	Forecast increase in average consumption, index 2000/1980
In material expenditures of entire national economy	0.689	1.193	1.73	2.157	1.81
Mechanical engineering	0.750	1.563	2.08	3.406	2.18
Electrotechnical engineering	11.198	24.754	2.21	57.181	2.31
Transport and communications	1.475	3.613	2.45	9.249	2.56
Other industrial sectors	0.219	0.215	0.98	0.221	1.03
Nonindustrial sectors	0.230	0.407	1.77	0.753	1.85
Nonproduction area	1.303	2.193	1.68	3.859	1.76
Personal consumption	0.981	0.641	0.65	1.121	1.75
Capital construction	2.742	3.727	1.36	6.559	1.76
As part of imports	2.206	1.975	0.90	6.500	3.29
As part of exports	2.773	4.650	1.68	7.790	1.68

But it is interesting to divide up these deliveries according to the most important sectors of the Czechoslovak national economy. In the production domain, first place is occupied by the electrotechnical industry, in which the relative electronics consumption increased from 11.2 percent in 1970 to 24.75 percent in 1980.

A high growth rate of relative consumption of electronics has been shown so far only by the transport and communications sector and the mechanical engineering sector, with indices of 2.45 and 2.21, respectively. In contrast, the other industrial branches have shown a slight drop in relative consumption of electronics, with an index of 0.98. In the nonindustrial sectors, the proportion of electronics deliveries increased from 0.23 percent to 0.4 percent. At the beginning of the period, the relative consumption of electronics in the nonproduction domain was 1.3 percent; by the end of the period it was 2.2 percent. In 1970, 2.75 percent of deliveries for capital construction were from the electrotechnical industry, but in 10 years the figure increased by a factor of 1.36. In contrast, in personal consumption, electronics accounted for only 0.98 percent of total offers in 1970, while in 1980 it had dropped to 0.64 percent. The most important shifts in the application of electronics, other than the electronics industry itself, took place in the deliveries of equipment for sets, and within this area, in deliveries for the use of the mechanical engineering and transport and communications sectors. There was a striking relative drop in the degree to which the needs of the domestic consumer market were met. Based on the expected development of the national economy, changes in its structure and

the formation of intersectorial ties, we may assume that through the year 2000 the increasing rate of consumption of electronics in deliveries of parts of sets for mechanical engineering and transport and communications will be maintained.

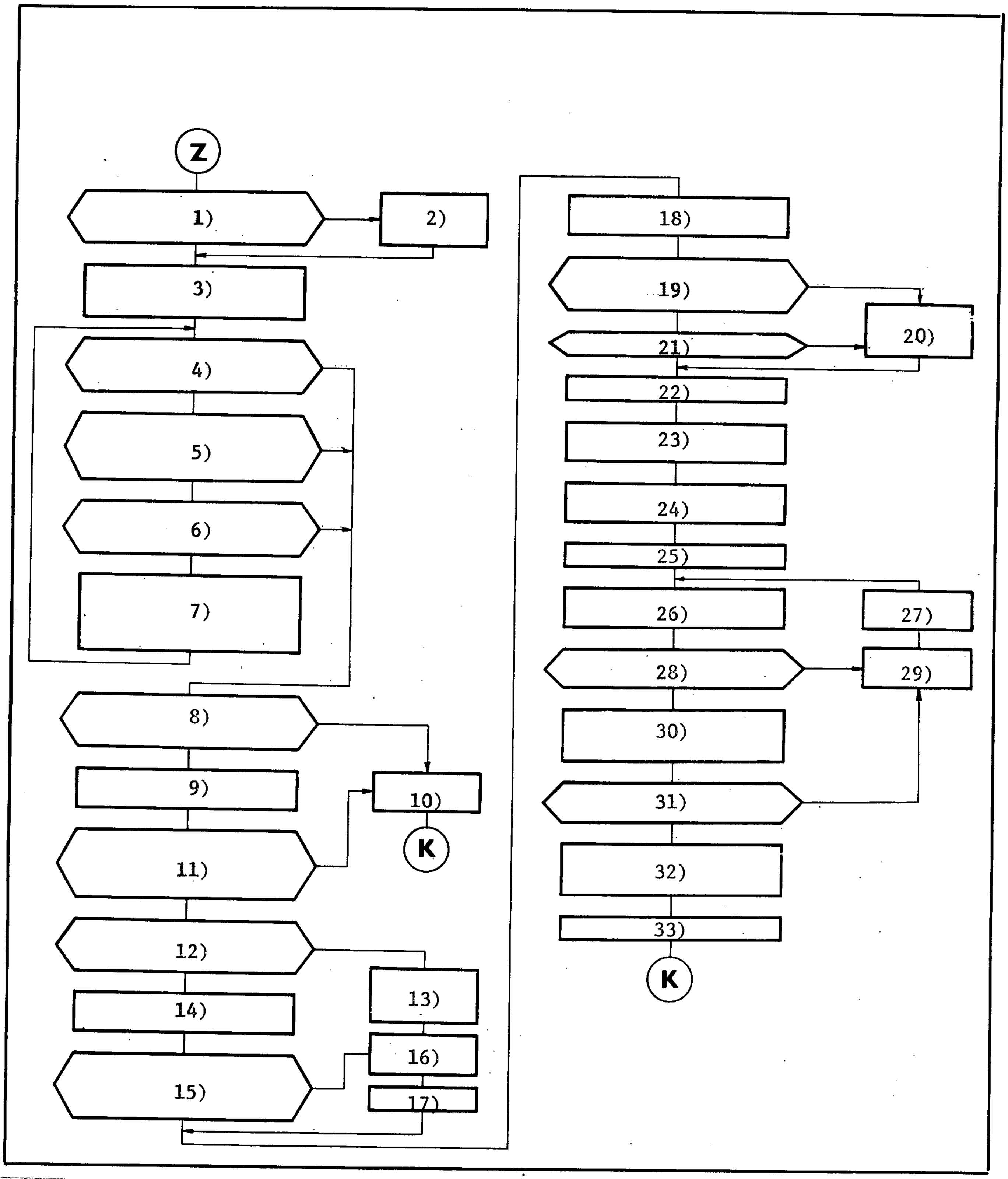
Electronics in Production and Nonproduction Processes

Electronic components, parts, assemblies, instruments and equipment are used as both investment and noninvestment tools in all sectors of the production and nonproduction domains of the national economy. Supplier-purchaser relations generally involve one-time deliveries of electronic equipment for installation, and further deliveries only in the case of maintenance and repair. The economic effect consists in a drop in the cost of production and nonproduction processes and an improvement in the quality of technical and other utility characteristics of the resulting products and services. Since this also involves deliveries of considerable size, which in several cases are negotiated and prepared for well in advance, the effectiveness of incorporation of electronics is based on multifaceted design (and not only technical design) as early as the preplanning stages. As an example we cite two cases found by the SEI CSR [CSR State Power Inspectorate] when it examined the effect of control electronics in improving the efficiency of energy consumption.

In the North Bohemian Paper Mills (Severoceske papirny) in Steti, electronics is used to control the papermaking machinery. After the introduction of a control computer, the weight of the paper was more uniform. This made it possible to set the machinery operating conditions at the lower paper thickness tolerance limit. This approach had not previously been possible, because the nonuniform weight of the paper made it necessary to leave a certain margin of safety in production in order to assure the minimum paper characteristics required by the technical specifications at the lower end of the tolerance range. Comparative measurement revealed that there had been a direct drop of 11 percent (i.e., 7,052 tons a year) in pulp consumption and a drop of 3 percent (18,126 gigajoules a year) in steam consumption. Indirectly there was a drop of 59,039 gigajoules in heat consumption and of 1,128 MWh in electrical energy consumption resulting from the saving of materials.

[see flow chart next page]

Typical flowchart for integration of microprocessors or microprocessor system into a final product



Key:

ANO = Yes; NE = No; Z = Start; K = End

1. Does the organizational leadership have clear basic knowledge of microelectronics and technologies for its implementation?
2. Provide instruction or add specialists
3. Choice of product for which innovation has highest priority, setting of date for market introduction of new product
4. Will the contemplated innovation result in a considerable improvement of the benefit/cost ratio in function?
5. Will the contemplated innovation yield a fundamental improvement in technical characteristics (saving of materials, decreased power consumption, etc.)?
6. Will the innovation qualitatively increase the utility value of the product (new functional use)?
7. Technical and economic parameters of assignment incorrectly established; must be revised, or if not possible, then left out of project involving innovation with microprocessors or microcomputers
8. Has the organization the required financial resources for research and development?
9. Decision to release them to the plan
10. Project cannot be carried out
11. Has the organization the necessary investment resources to create the conditions for producing the innovated product?
12. Has the organization its own specialized research and development capacities (electronics engineers and programmers)?
13. Decision to carry out external cooperation
14. Decision to furnish research and development capacities
15. Is there sufficient time (at least 18 months) to carry out the development complex with in-house capacities (with reference to market requirements)?
16. Development of concept
17. Design
18. Develop definitive conception of innovation project
19. Has the inclusion of sensors and actuators in the innovated product been worked out?
20. Assign to specialized organization for simultaneous working out
21. Has artistic design of product been worked out?
22. Fabricate hardware prototype
23. Buy and install development system for system development
24. Develop program flowchart
25. Develop program
26. Hardware-software integration and system testing
27. Program revision
28. Do results meet specifications of assignment?
29. New revised specifications
30. Test operation with prototype in conditions and environment of actual operation
31. Does system meet marketing requirements and has it been accepted for production?
32. Assign production of program mask, develop and provide specifications of test programs
33. Begin producing microprocessor system

Cases have also been found in which the introduction of computers and control electronics had a negative effect on energy consumption and other technical and economic indicators. The cause, however, was not electronics, but a design that did not take account of all factors. At the Holicky Works of TOS Hostivar [Machine Tool Works] k. p. [concern], production is carried on primarily in unsuitable buildings of an earlier shoe factory which are more than 100 years old. In particular, these areas cannot hold individual NC [numerical control] machines, which is one of the basic preconditions for use of their capabilities. The key to their placement is functional interdependence. The size of the individual machines turned out to be the critical factor in their placement in this plant. Another deficiency was the incompleteness of the solution adopted. The machine shop is equipped with NC tools, but materials and accessories handling remained unchanged, i.e., they are not and cannot be automated. The plant has not yet effectively built and introduced a comprehensive automated control system. Computers determine only the production schedules. The use of NC machine tools is also hindered by maintenance, which is subject to excessive demands in view of the great variety of workplaces. For these and other reasons, after the introduction of NC machine tools the energy consumed in production increased by about 30 percent.

These two instances show that when implementing electronic control systems for production machinery, the equipment or process interacts strongly with the production environment, and, via this environment, with the entire system of economic functioning.

It is understandable that automated tools can be provided with electronic components and systems of various degrees of intelligence, and thus at various price levels. The cost of this equipment depends directly or multiply on the "indeterminacy" of the production and nonproduction process. This indeterminacy can be eliminated primarily by two methods: either by organizing the manufacturing environment, which means creating the conditions (climate) for precise, stable organization of this process, and thus considerably improving it, or by reacting to it with adaptive cybernetic equipment with a sufficiently high degree of intelligence, which is more expensive. The problem is to decide which is the more suitable expenditure in any specific situation. "Organizing the process environment" means instituting a level of time and space organization and production which is commensurate with the requirements posed by automation.

A significant policy for a greater degree of utilization of electronics, i.e., automation, presupposes a highly organized, stable level of organization of production and services. But this by no means implies that automation has to be put off if the ideal organization of production and services has not yet been achieved. We wish only to emphasize that even given the historically and economically necessary development of incorporation of electronics into the national economy, all organizational shortcomings will have a much more perceptible effect on the effectiveness of use of electronically equipped workplaces. From this it follows that the tasks of improving the organization of production and services, including economic tools and methods, are even more important today, and that they must be solved without delay, in the best way possible, both where automation is to be introduced and where it is already in place.

Increased use of electronics in the means of labor will be an essential condition for the passage of the production base (particularly in mechanical engineering) to a higher level (in scientific and technical terms). But beforehand, and in the interest of this process, the mechanical engineering industry must develop and start the production of the required quantities of a variety of equipment, without which automated technology can be neither produced nor utilized.

Electronics in End Products

Another group of applications of electronics today involves their functioning as objects of labor built into final mechanical engineering products. This installed modular type of application is likely to occur most in mechanical engineering and consumer products. In these areas, supplier-purchaser relations involve continual deliveries for the final production. In this case the effectiveness of such applications depends, first, on improving the technical and other utility characteristics of innovated final production, and, second, on the cost of incorporating electronics into it. But in all cases where it is an inseparable part of the machine, the electronics must perform a function without which the final machine could not achieve the required technical characteristics. Then we cannot speak of the cost-effectiveness of application of an electronic component, but only of its effect on the cost-effectiveness of production of the product of which it is a component. In both of these cases of application of electronic components and systems as parts of objects of labor, the technical and economic approaches interpenetrate each other in the conception of the final product.

In economic terms, the incorporation of microelectronics has hitherto been hindered by high production costs, which result in excessively high prices for the final product. For example, the preliminary price limit of the MS 155 papercutter with the MAXIT 1 control system is calculated as Kcs 216,000, while the price of the standard MS 115-S model (without program control) is Kcs 104,000. The price of the device with this electronic equipment is thus more than 100 percent higher, while the increase in such machines with their electronic components in the case of competing foreign products is only 40 percent because of the lower price of this equipment, while giving a corresponding improvement in technical and economic parameters.

A basic (i.e., technical-economic and market-policy) analysis must be carried out before specifying the technical characteristics for design of a microprocessor or microcomputer system to form part of a final product. This stage includes many basic decisions related to the development of specifications for an innovation and implementation of an innovation project. The main considerations are in three mutally interrelated areas:

--analysis of the market for this commodity here and abroad;

--evaluation of the technical objectives of innovation of the final product and ways of achieving them;

--evaluation of the economic effects of this innovation project.

In the economic sphere it is particularly important to evaluate the degree to which the innovation will decrease costs for the product or the function, with its resulting effect on the price of the product or its overall production. A basic analysis oriented toward the individual product or groups of products is, however, interconnected with the enterprise's innovation strategy and with the development concept of the sector involved. The projects which spring from it involve restructuring, legislative changes and investment policy. The production of products incorporating electronics obviously creates a need for service organizations with the requisite accessories and requirements for specialized personnel. These measures and decisions must accordingly be worked out in the long-term plans and in the trade policy and technical-economic guidelines for development of the relevant organizations and sectors.

In Conclusion

Incorporation of electronics into the national economy differs from other programs of social and economic development primarily in its mass character and cross-cutting nature. For example, in the case of energy programs it is almost always possible to communicate with experts at the necessary level; any cases of their absence are negligible. But the shortage of experts in the expansion of the use of electronics is drastic in some cases. Accordingly, training experts is of the highest importance. The mass scale of the use of electronics also creates the need to intensify technical publicity for the entire populace. The conception of workers' specialized training for electronics applications must include not only the necessary skills, i.e., specific knowledge and experience with the functions of electronic products, a knowledge of their capabilities and limitations, methods of using them and the like, but also specific knowledge and experience in evaluating economic and extraeconomic factors at all levels of management.

The cross-cutting nature of electronics, i.e., its ability to penetrate into all sectors of the production and nonproduction areas of the economy, makes it necessary to create a suitable information system and an effective management mechanism for the incorporation of electronics into the national economy. The special-purpose program approach is a suitable mechanism for arranging all ties and dependencies in comprehensive fashion and integrating the necessary resources and objectives of this key program.

8480
CSO: 2402/28

ROBOT PRODUCTION PLAN FOR 1981-1985 UNDER FIRE

Prague TRIBUNA in Czech No 7, 1983 p 16

[Article by Milos Fibiger, chairman of the CR CSVTS [Czech Council of the Czechoslovak Scientific and Technological Society for Automation and Robotization]: "More Consistency Needed"]

[Text] The robots seen in exhibition halls and films are getting into our factories only very slowly. This procrastination should not be mistaken for prudence, because, in comparison with the rest of the world, this position does us no honor. In preparing for greater use of robots and manipulators we must realize that time is working against us and every unnecessary hesitation and simple solution mean losses that will be hard to make up for.

During consultations for developing plans of science and technology at the State Committee for Science and Technology of the Soviet Union 10 years ago, J.A. Nazarov, director of the Engineering Department, recommended that we work toward the development and production of industrial robots and manipulators. He also perceived them as a very good future export specialty. Also in that same year--1972--the first microprocessor was invented and microelectronics was beginning to develop rapidly. This contributed to the rapid development and introduction of the automation of production processes and then, especially, to the development of robots and manipulators. Of all the known fields, these have grown at the fastest rate in recent years.

A year ago the CSSR Government and both republic governments approved the concept of industrial development of robots and manipulators, placed this in the state's target program and adopted several measures to assure implementation. According to this concept, 3,000 industrial robots and manipulators should be in operation by 1985. The government directed five federal ministries and five national ministries in each republic to prepare a program of robotization in their departments and appropriate economic units by 30 August of last year. By the end of last year the Federal Ministry of Technological and Investment Development was supposed to issue methodological instructions to estimate the economic efficiency of automated work centers utilizing robots. The Czech Government directed the ministers to cooperate

on this problem with the Czech Council of the Czech Scientific and Technological Society.

Even before we examine in more detail the whole development of robotization, its advantages and disadvantages, good and bad experiences, it must be stated that the government's objectives were not achieved in many respects, either with regard to time limits or quality. Achieving the full objective by the end of the Seventh 5-Year Plan is therefore seriously threatened!

We Know the Future But Still We Hesitate

The development of robotics here must be set in the overall frame of world trends in automation and robotics, including the approximate goals which industrially developed states can be expected to attain in this sector in the future.

Electronics speeded up the automation of production so that even today we can predict with a certain degree of accuracy what production processes, plants and enterprises will look like in 20 to 30 years. For the most part, people will no longer be doing work that is physically strenuous, hazardous to the health and monotonous and will work only a single shift while production processes will automatically operate all 24 hours. Productivity and usefulness will increase severalfold. Compared with conditions today, we will need about one-half less production space and electrical capacity and it will be possible to convert facilities with each new innovation.

Compared with today's conditions in some plants, these ideas seem like fantasies. We must, however, realize and also convince ourselves that this is a reality which we can cope with here too. It is not a question, for the most part, of basic research and discoveries but only of completing and making use of today's experiments! How we are starting to test flexible production systems with industrial robots and manipulators in operation and every month new ones are being added. There are several key plants in various stages of design preparation and completion planned for operation with high degrees of automation even though in some cases it will still be necessary for the time being to work under provisional arrangements, with currently already obsolescent technology.

According to approved plans of technical development in basic research for the state's 07 target program and the target programs of basic research, production of adaptable robots and robotized work centers will be started in the next 5-year plan utilizing elements of artificial intelligence.

But when it comes to quantity of designs and particularly their execution, we cannot compare with the rest of the world. We are especially lagging in quality and reliability. But in inventiveness of designs, their testing in model work centers, workshops, operations and plants we can claim without exaggeration that we rank with world standards!

We know what our difficulties are. But other countries too, rushing forward at dizzy speeds have run against complicated problems and are still doing so.

Some are objective, others subjective. On the one hand, Japan is even now producing more than 10,000 robots annually and, according to certain forecasts, in 1990 will produce about 60,000 robots, the United States 25,000, the FRG 15,000, etc. On the other hand, an average of 200,000 persons becomes unemployed every month in the capitalist states and in less developed countries 660 million jobs will be needed in 20 years.

We, too, cannot close our eyes to these developments but we have enough time --though not too much--to solve these problems and all their implications systematically. We can expect big structural changes which, with proper diagnosis and long-range planning, can bring enormous improvements to all our living conditions.

Useless Dissipation of Forces

The present level of robotics in the national economy is not good. Through our own fault, for no objective reasons, we are slowly getting ourselves into a stressful situation.

We have many ideas, programs, plans and commitments directed toward robotization (but not always in good proportions). I also believe that there is no lack of promotion and publicity--conferences, seminars, exhibits, congresses, information and discussions in the press, on the radio and TV. Some ministries have specified how many robots and manipulators or how many automated technological work centers are to be introduced by this or that enterprise. Nevertheless, we must state that the realization of even our relatively modest objectives is threatened. The main reason for this can be seen in an example of the robotization of welding.

There have been four international conferences since 1975 on the use of industrial robots and manipulators in welding. Since 1972, one of the state goals in Detva has been the construction of an integrated production sector for welding box assemblies. At the end of the Sixth 5-Year Plan a cooperative socialist commitment was solemnly concluded to establish 100 to 150 robotized welding work centers by 1985. The commitment was signed by 4 deputy ministers and 37 enterprise directors. And what was the result?

One robotized work center in CKD-Lokomotivka [heavy engineering] is currently operating in three shifts, three work centers have been in operation not quite a year in the Heavy Engineering Works in Detva and one has been completed in Deste Domazlice using their own resources. We did develop a suitable robot which was even awarded a gold medal at a specialized exhibit in Brno and the Klement Gottwald State Prize. In the meantime, however, none of the five has all the qualities necessary for such a demanding operation and they are costly. With all the positioners and other equipment of the work centers, the cost will be more than Kcs 2 million. Each one is unprofitable. Nevertheless, we will develop many more robots: two according to the state plan in Detva, another in the department of Prof Bretislav Chvala at the CVUT [Czechoslovak Military Institute of Technology] Prague, and the High Voltage Electrical Engineering Works VHJ [economic production unit] developed the PRAM 3 robot in cooperation with the Engineering Technology and Economy Research Institute, Prague. Even though many various kinds of robots are needed for welding, this represents considerable fragmentation of forces.

After 7 years, we are still scarcely producing a single standard facility. Only some dozens of robots of this type are planned by the end of the 5-year plan but these depend on capital investment which has not been secured. The Electrical Engineering Works in Bratislava will start producing positioners beginning only in 1986 and the users will not pay the actual costs. On the other hand, training preparation of the designers of welding work centers has not even begun. The short 1-week courses for this purpose are inadequate. To meet our socialist commitment we would need at least 100 trained designers.

In Japan, they put into operation well over 1,000 robotized work centers for arc welding every year, whereas they had only a few dozen around 1975. Key organizations which are responsible for the development of welding here--the Research Institute of Welding in Bratislava and the Bratislave Electrical Engineering Works--have not done nearly all that they could and that is in their power.

Comprehensive Preparation is Lacking

In spite of great efforts, we cannot boast about any really practical successes in other sectors either. Over 10 robots and manipulators have been developed and a few score robotized work centers are in test operation. What then is the reason for our lagging behind?

It is, first of all, inadequate comprehensive preparation, even though some employees and particularly the leadership of the Research Institute of the Metal Industry, Presov, did strive hard for it. The user sphere which must include appropriate technological institutes and organizations, for example, in engineering the Research Institute of Welding, Bratislava, the Machine Tools Research Institute of Prague, the Research Institute of Shaping Technology in Brno, the State Research Institute for Engineering Materials in Prague and others, almost all of which, with a few exceptions, and without much initiative, proceeded tardily to prepare prognoses, programs and plans for automation and robotization. In nonengineering branches the situation is even more critical. There are, however, exceptions. Among these is, without doubt, the State Research Institute for Protection of Metals, Prague, which as early as 1980 had a good prognosis available on the use of industrial robots and manipulators for surface finishing. Up to this time, such programs generally do not exist, much less is there any assurance of favorable development. What is lacking is preparation of qualified specialists, analyses of the most suitable application of robots and manipulators and a model design worked out. The research Institute of the Metal Industry, Presov, alone is not equal to all this, even though it is doing a good part of the work. It must and can help out with its experience but to lay all the problems of robotics an its "shoulders" is somewhat beyond its powers.

Preparation from headquarters that was inadequate and poorly directed led to the fact that formulation of the robotization program by 30 September of last year along the lines of VHJ by the 15 ministers as directed by the government was at times very superficial and the results were far short of the needs.

Factories that were supposed to prepare their own programs of robotization did not have enough information at the time about current, and especially future, possibilities. They did not even receive in time a uniform methodology for drawing up the programs, computing their effectiveness, cost of the equipment and especially the cost development because today's prices do not correspond to useful values. These and other influences--the time limits for preparing special programs of such difficult and dynamically developing proportions being too short for the formulators in the plants, even the terminology not explained, the testing worksites not being, with a few exceptions, in full operation, etc.--All this often magnified the shortcomings of the first robots and manipulators manufactured here.

The first series of trials had and still have, plenty of problems. This is partly because every innovation of a higher order requires a certain time for thorough testing in practice but also because the collective teams working on them were generally young and inexperienced and often also because of poor-quality production. Automation facilities which are unreliable and subject to breakdowns do more harm then good, especially in the collectives which are supposed to work with them further. Then too, certain workers, out of ignorance or malice, make the errors and defects even bigger. So at present many succumb to pessimism and skepticism and typically repeat: "Forget about robots for the present. First of all, make them of good quality, so they are reliable and will last at least 2,000 hours between two breakdowns and so they can be provided at a cost which guarantees that the whole automation technology of working with robots and manipulators will pay for itself in 2 to 3 years. Make then in the necessary variety, make them with peripheral devices, if possible with a key and give us the investment capital for them. Then we will use them here too. As it is, we often cannot get the regular machinery we need for production."

We must fight stubbornly and resolutely against such opinions, even though they appear to be logical and true. We must not lose sight of the clear and inevitable future prospects because of temporary difficulties.

8491
CSO: 2402/34

BRIEFS

SCIENTIFIC GOALS IN AGRICULTURE--This year agricultural and food research institutes in the Czech Lands have been working on 420 research tasks, of which about 35 percent pertain to crop production. The CSR Ministry of Agriculture and Food has been supported in its scientific research efforts by 41 research facilities employing 11,000 workers. One of the key tasks is establishment of a genetic bank at a research institute in Prague-Ruzyne, which will contain about 100,000 genetic sources. Also being developed is a new system of liquid fertilizers which will be 5 percent more effective compared with the current solid fertilizers. New technologies have been developed for production of 47 t/ha of sugar beets and 30 t/ha of potatoes, which will be implemented already this year at selected unified agricultural cooperatives. Innovation of more than 1,500 food industry products for 1982-1985 has been underway. [Prague SVET HOSPODARSTVI in Czech 8 Mar 83 p 1]

CSO: 2402/40

HISTORY, STRUCTURE, FUNCTIONS OF SCIENCE POLICY COMMITTEE HIGHLIGHTED

Budapest MAGYAR HIRLAP in Hungarian 1 Mar 83 p 5

[Interview with Academician Pal Tetenyi, secretary of the TPB, by Erika Zador: "In the Workshop of Science Policy: Guiding Principles, Plans, Resolutions, Coordination;" date and place not given]

> [Text] In our homeland about 3-3.5 percent of the national income goes to research and development; 1.6 percent of the active workers and about 10 percent of those possessing diplomas work in the more than 1,300 research sites, universities, research institutes and enterprises under the guidance of various chief authorities. There can be no doubt that an activity of this size affecting so many requires coordination designating the chief science policy principles and directions and the most important tasks and supervising execution. This coordinating activity falls on the Science Policy Committee [TPB] working with the Council of Ministers. The members of the committee are leaders of the Hungarian Academy of Sciences [MRA] and of the National Technical Development Committee, ministers and state secretaries, and the chairman is a deputy chairman of the Council of Ministers, Istvan Sarlos. The secretariate of the TPB takes care of operational tasks and the secretary of the committee is Academician Pal Tetenyi.

[Tetenyi] The committee was formed in 1969 in the wake of the science policy resolution of the MSZMP. But this does not mean that organizations with similar tasks did not operate earlier. The predecessor of the TPB was the Technical Development or Scientific and Higher Education Council functioning within the framework of the Council of Ministers. The present tasks of the TPB were fixed by a 1978 resolution of the Council of Ministers.

The basic task of the TPB is to develop state science policy, ensure a system of conditions for it and modify it as necessary, making possible the fulfillment of the research and development [R&D] tasks deriving from social policy and

economic policy tasks and from the internal development of science. These include, for example, maintaining the infrastructure of science, questions connected with the organization of the research network and distributing financial resources among the various areas. One of the central tasks is to work out an R&D planning system. This includes national, ministry level and institutional long- and medium-range research and development plants. Concretely, the committee causes to be developed, debates and submits to the Council of Ministers the national medium- and long-range plans but it does not have the task of working out more detailed plans. These are prepared by the appropriate institutions; the OMFB [National Technical Development Committee] and the MTA coordinate the work on behalf of the TPB. The committee prepares for the Council of Ministers reports and recommendations dealing with science policy--thus it has a decision-preparation function--but it also passes resolutions in what lawyers call its "deputized authority which are binding on the ministries.

[Question] How does the committee work? What sort of apparatus does it have to guide this complex, multifaceted work?

[Answer] The secretariat has six actual members; this is enough for this work. The concrete tasks--which are designated by resolutions of the committees--are carried out at the appropriate ministries and institutions. The OMFB and the MTA play a preeminent role in preparing and carrying out the decisions of the committee. The TPB also has subcommittees. These are the Social Sciences Coordination Committee, the International R&D Contacts Coordinating Committee, the National Scholarship Council and the Large Research Instruments Committee.

[Question] Why do you have a social sciences subcommittee and not a natural science one?

[Answer] The operation of the Social Sciences Coordination Committee is justified by the research organization of the social sciences and by the outstanding direct social significance of the research. As is well known, social sciences research is organized by branch of science; there are, among others, historical sciences, linguistic and literary science, economic, sociological and philosophical faculties and research institutes. But an examination of the various questions and social phenomena put on the agenda by social development requires research which brings together the various sciences. A study of changes in social structure and social strata, working out a social policy concept, educational science tasks, discovering the national past, a scientific foundation for economic policy, a study of and the further development of the economic and state administrative structure or research on deviance (as a social phenomenon) make necessary concrete research programs requiring the participation of experts from the most varied branches of social science, organized on a broad basis. So there is a need for a coordinating committee bringing together the various social sciences, practical experts and representatives of the ministries. The situation is different in the case of the natural sciences. The practical utilization of these takes place primarily within the framework of technical development; the OMFR and its organs perform the coordinating activity, so the functioning of an additional coordinating committee would be superfluous. It is the task of the subcommittee dealing with international contacts to help make use of foreign scientific contacts primarily in the interest of realizing domestic technical development priorities.

[Question] Does this mean that it does not support the cultivation of contacts lying more distant from the chief trends?

[Answer] Not at all! We must exploit every rational cooperation possibility. In any case, the chief trends cannot be rigid--as a consequence of the swift development of science--just as our research plans cannot be rigid either. The subcommittee, as its name implies, does not guide in this area, it only coordinates. I must add, however, that in general our more significant international cooperation plans do coincide with the chief trends, with the priorities. In many respects the researchers of the partner countries are striving to solve similar problems and the mutually advantageous agreements contribute to the development of both countries alike.

[Question] A significant sum from the resources of the country is turned to R&D about 100 billion forints in the current Sixth 5-Year Plan. How does the TPB dispose of this?

[Answer] The committee determines the chief directions of distribution; the ministries dispose of 44 percent of the resources and the enterprises dispose of 52 percent. The sum which the committee can distribute directly is 1 percent and there is, in addition, a reserve fund of 2.5 percent.

[Question] Even 1 percent of the R&D is a respectable sum, 1 billion forints. To what purposes does the TPB turn this?

[Answer] From this we contribute, for example, to the central social science research programs, we support university research and various competitions. The reserve fund serves as a material base for unexpected tasks. An example of this is the medical biology program which we added to the medium-range research plan.

[Question] And what influence does the committee have on the use of the rest of the money?

[Answer] The committee influences use of the resources among other things by means of determining the ratio of central and enterprise resources and the inter-branch ratios (within the framework of preparing the annual national economic plan), primarily by determining the chief R&D directions. But, naturally, the enterprises, institutes and ministries decide independently on use of their own resources.

[Question] Like other government organs the committee inevitably makes decisions which hurt personal or group interests. I am thinking here, for example, of the 1980 resolution of the Council of Ministers concerning the reduction in research institute personnel and the reorganization of the research institutes, passed on the basis of a submission by the TPB...

[Answer] The transformation of the research institutes planned for the years 1981-1983 took place in accordance with the resolutions; a number of them became developmental enterprises. These included, for example, the Instrument

Industry Research Institute, the Fruit and Ornamental Plant Propagation Research Institute, the Silicate Industry Research Institute and others. But in most places this change meant merely the recording of a process already begun; even earlier these institutes were dealing primarily with development in what was increasingly a profit interest system. As for the reduction in personnel, this was certainly an unpopular measure but it was absolutely necessary. The effectiveness of Hungarian scientific research is not in proportion to the number of researchers. The research sites must be selective and must hold on only to people really suitable for research.

[Question] I agree with you perfectly, but in the course of realization did they really get rid of people representing a superfluous burden, did not the gates of the research sites get shut to young people wishing to test their talent, was this not done out of an unprincipled pseudohumanism?

[Answer] Naturally the execution of concrete individual decisions depends on the institutions and supervision is the task of the supervisory organs or ministries. Naturally there may have been internal measures with which I do not agree, as secretary of the TPB or as a private person, as a practical researcher. But this belongs to the authority and responsibility of the leader of the ministry involved, of the institution...I feel that if incorrect cadre policy or bad organization appear in the work then the chief authorities will take the appropriate steps. It would be incorrect in principle and harmful in practice if a government committee were to presume to take over these tasks. In any case, we regularly check up on the execution of resolutions passed by the TPB, on the fulfillment of the various programs. This is done partly on the basis of reports prepared by the chief authorities and partly with the joint work of experts invited by us, of colleagues from our secretariat and from the ministries. The TPB does its work with a constant analysis of goals and achievements and, as a working organ of the government, it constantly informs the Council of Ministers about its activity.

8984
CSO: 2502/28

ENERGOINVEST DEVELOPING INDUSTRIAL ROBOT TECHNOLOGY

Sarajevo OSLOBODJENJE in Serbo-Croatian 2 Mar 83 p 7

[Interview with Halima Cipovic, electrical engineer and head of the Robotics Group at the Energoinvest Institute for Automation and Computer Sciences, by Dusica Kljajic: "The Robot on the Job; the Automation of Production Processes"; date of interview not given]

[Text] Expert at the Energoinvest Institute for Automation and Computer Sciences now have the know-how to begin making robots.

Many analysts believe that by the end of the century industrial robots will be the basic form of automation of production processes. Robots are universal automatic systems capable of high-level functioning. The ability of robots to be programmed and to be active participants in their work environment sets them apart from other forms of automation. Robotics is an interdisciplinary field in which Energoinvest is participating. A significant body of knowledge, experience, and technology in virtually all areas necessary to the construction of robots already exists in Energoinvest institutes, and in production and other organizations. Hopefully, this will be an adequate prerequisite for proceeding in this area, an area which will have a significant commercial impact within 10 years.

Energoinvest is just beginning to enter this area, and before commercial exploitation is possible it will be necessary to learn the basics.

In the Institute for Automation and Computer Sciences there is a group of experts which make up the Robotics Group headed by Halima Cipovic, an electrical engineer. We spoke with him and learned what has been done in this area of Energoinvest.

First Do a Study

[Question] One of the seven projects of common interest for all of Energoinvest is the industrial robotics project. What has been done up to now?

[Answer] The first thing we did in this area was to do a study entitled "The Future Use of Robots in Energoinvest", which was finished in April 1980. The purpose of the study was to acquaint Energoinvest with this area, and to see

how much of what we had already learned in research, development, and production was applicable to the development and use of robotics. Energoinvest has developed production processes which have a manufacturing method like one which uses robots in other parts of the world. Robotics will influence the future competitiveness of production using these production processes. There are places in Energoinvest now which are ripe for the use of robots. They are: the foundry, the armature factory, the factory which makes power-line poles, and others. To begin with, robots would be used in jobs which are very difficult and very dangerous. To give you an idea of how the use of robots would be justified in difficult job situations, let me give you an example: a worker working continuously for 8 hours must lift a total of 10 tons. This tells you of the need and the justification for entering into this area.

Job Application

[Question] Has the industrial robotics project received a positive evaluation in Energoinvest, and is it now being implemented?

[Answer] The project is being carried out in a couple of activities which are going on simultaneously: in the development and construction of a model of an industrial robot, and in actually using a robot. The ultimate goal of these activities is to master the knowledge necessary for understanding robotics, and for the construction of our own robots. We are doing this by taking pre-programmed robots which we acquired by purchase, adding intelligence structures to them, and turning them into intelligent robots. This will be the first step taken by Energoinvest toward the production of technological equipment for production processes. One must carefully choose the place where the robot will be working. It is in relation to this place that the purchased robot, which has been programmed and installed, must demonstrate the possible effects of the use of robots in Energoinvest.

[Question] What is the group of experts in IRCA working on now?

[Answer] It is now in the process of completing a project with this description--"the manufacture of an intelligent robot capable of sorting routines using a pre-programmed robot acquired by purchase, and the development of the structure necessary to make it an intelligent robot."

Turning a Pre-Programmed Robot Into an Intelligent One

[Question] A pre-programmed robot was purchased as part of IRCA's experimental plan, and you are trying to make it into an intelligent robot.

[Answer] A pre-programmed robot is one which does not possess knowledge about the outside environment and the object with which it is working, but only knowledge about its own workings. This is purely a programmed device which ideally requires a pre-determined work space. A robot set up in this way works continuously until someone turns it off. We bought one of these and it is only to be the physical operating mechanism of the model of the intelligent robot which we are building, and which is the ultimate goal of this project and the object of our research.

In other words, we are working on the development of a system which will be able to identify one specific object among many arranged in a random manner.

[Question] The research engineers are working on this project?

[Answer] Yes, six research engineers are working on it, as well as several colleagues from the electrical engineering faculty at Sarajevo. Right now we are working on the development of algorithms for the recognition and identification of objects with the help of the analysis of a picture obtained through a camera. Results have already been obtained. These algorithms will be used in a mini-computer which will be a component part of the intelligent robot model.

[Question] Has this type of intelligent robot been made anywhere else in the world?

[Answer] As far as we know, this type of robot is not commercially available. Research is being carried out at several scientific research organizations throughout the world.

[Question] Is Energoinvest considering the use of its own robot?

[Answer] We have the knowledge and experience in developmental problems and in technology in virtually all areas which relate to robotics, and this makes us ready to make our own robots when the time comes.

Robotics is an interdisciplinary area using elements of servomechanism technology, multi-variable systems, regulation of technical parameters, precision mechanics, kinematic theory, etc., and work in these areas is an essential prerequisite for entry into the field, and for the further development of scientific research organizations such as IRCA.

9548
CSO: 2802/2

END

```
B1 - CONTROL NUMBER:   U194015
B4 - ACCESSION NUMBER: ...........................JPRS-83293
B3 - COLLECTION CODE:  3
B6 - MANAGEMENT CODE:  XR
B7 - PROCESS ACTNG CD: 01      B7A-REGISTRATION FEE: 00000
B8 - PRODUCT MANAGER:  H
B9 - RECEIPT TYPE:     1       B9A-LOAN DUE OUT:
B10- TRANSACTION:      TN      B10A-DUPE/PRIOR/SUPER:
B12- RETURNS:          0       B12A-RETURN DATE:
B13- PROCESSING:       1
B14- PAT. POTENTIAL:   0
B17- FORM/PRICE:       12002 ,
B18- ANNOUNCE:         0000
B19- PUBLICATION-1:    u8322   B20- PUBLICATION-2:
B21- LIMITATION:       0
B23- PC BIN:           000
B24- STOCK:            0009    B24A-STOCK TYPE CODES: D
B25- PAGES/SHEETS:     00031
B26- PC PRICE CODE:    A03
B27- DOMESTIC PRICE:   0000000 B28- FOREIGN PRICE: 0000000
B29- ACTION CODES:     SS
B33- MN PRICE CODE:    X00
B34- DOMESTIC PRICE:   0000000 B35- FOREIGN PRICE: 0000000
B36- ACTION CODES:     XM
B37- RELEASABILITY CD: A
B38- MF PRINT:         D
B39- ADDITIONAL INFO:  n
B40- PRINT PC:         n
B41- PC DUE:           n
B42- SOURCE ORDER:     n
B42A-GENERATE RDP:     0
B42B-SUPPLIER SRC CD:  n
@06 )East Europe Report, Scientific A@@@
ffairs, No. 775.[                  @@@
@11 )19 Apr 83,[                   @@@
```